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WHAT IS THE FUTURE OF ARMY AIR AND MISSILE DEFENSE?

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ABSTRACT

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This paper will provide a critical review of the Army's transformation plan as it applies to Air and Missile Defense. This is accomplished by reviewing national requirements, threat, and historical precedent. The Army has traditionally built a land power force to promote and protect our national interests. As the aerial threats have evolved from being aircraft-centric to missile-centric, does the Army's transformation plan provide adequate flexibility and sufficient full dimensional protection for Joint Force commanders and the nation? By examining the current status of transformation and defining the anticipated threat this paper will examine specific areas of concern and offer possible solutions in terms of capabilities, priorities, and force structure. It will also provide a series of historical comparisons that are relevant to the evolution in aerial threats that is occurring today.

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WHAT IS THE FUTURE OF ARMY AIR AND MISSILE DEFENSE?

> Technology can lead to enhanced environmental mastery—but it can also lead to fatal dependencies.
>
> —Ralph Peters[1]

The U.S. Army has been in the process of transforming for four years now. It is well understood by most that all aspects of the military must transform to meet the need for future capabilities against unknown threats. This paper will examine the direction of the Army's transformation efforts in terms of Air and Missile Defense (AMD) and attempt to show that the Army is not on a path that will enable it to meet future threats and provide the future Joint Force commanders with the appropriate assets to necessary for full dimensional protection against emerging aerial threats. In fact, it will show that considerable risk is being assumed by not developing capabilities to defeat difficult aerial threat sets. This paper will examine the Army's air and missile defense requirements both historically and today as well as the historic and future evolution of aerial threats and their implications for the future. These requirements and threats will then be contrasted against the current short-term (10 yr) AMD transformation plan to highlight shortfalls in capability. As Army transformation is a dynamic and evolving area this paper will only focus on the major trends or directions and not on specific technologies or capabilities as they are beyond the scope of this piece.

In his book, Fighting for the future; Will America Triumph? Ralph Peters states that we are "preparing for the war we want to fight…not the conflicts we cannot avoid."[2] Mr. Peters wrote this in 1999 and the events of September 11, 2001 brought home this very fact. While we had focused on defeating a traditional sophisticated military threat we discovered that an unconventional enemy using our own resources was able to do considerable damage in terms of economics, loss of life, and arguably to the national psyche. As an example, we found that our entire system of air traffic control was based on cooperation and that when an aircraft decided not to cooperate it could not be seen by much of the air traffic control system. How could this happen? It was assumed that anyone flying in U.S. airspace would be friendly and consequently the system had no measures to deal with any other likelihood. Charles Dunlap, in his essay on asymmetrical warfare and the western mindset, contends that it is our western values that we feel define us, are in fact the asymmetries that future adversaries will seek to exploit.[3] There are certainly many other lessons to be learned from this tragic event.

General Shinseki has made a resolute effort to change the course of the Army's focus to enable us to deal with conflicts that may not be of our choosing. The Army has been very receptive to change in some areas, such as direct fire lethality, sensors, and deployability. A much lesser degree of receptiveness has been demonstrated in transforming the Army's Air and Missile Defense Force. While the Army is aggressively seeking to improve on the many ways it has to kill enemy soldiers and armored vehicles it has failed to develop a capability or improve its current capability of defeating future aerial threats. In fact four years into transformation, the Army does not have an approved plan to transform AMD. This might be acceptable if there was depth and redundancy in our capability to defeat aerial threats but there is not. The Army's approach to AMD is an extraordinary example of "preparing for the war we want to fight." In order to properly understand the shortcomings with the AMD transformation plan today it is important to examine its history.

HISTORICAL BACKGROUND OF THREATS AND CAPABILITIES

> Military history, accompanied by sound criticism, is indeed the true school of war.
>
> —Lieutenant-General Antoine-Henri Baron de Jomini[4]

Much of what is happening today and probably in the near future in terms of AMD has historical precedent. Essential to being able to plan where the Army must go with AMD in the future is understanding the evolutionary origins of present day AMD requirements. Without the underpinning of these relevant historical lessons it is impossible to appreciate the importance of a comprehensive integrated AMD architecture.

The military's constant need to occupy the "high ground" in order to improve a commander's situational awareness is timeless. When the airplane was first militarized prior to World War I little thought or planning was given to the need to defend against its capabilities. Necessity being the mother of invention, the European nations, because of their early involvement in WW I, adapted existing direct fire weapons to mitigate the effects of the airplane. The U.S. Army was very slow to recognize the military significance of the airplane and when the U.S. entered WW I it was forced to use French weapons in order to provide protection to its own forces. Gradually the effectiveness of the airplane was recognized as well as the impact it could have on military operations from both the friendly and enemy's perspective. The feeling of vulnerability that this produced forced the Army to rapidly develop counters to the airplane. The Army searched within itself for the expertise necessary to develop these new air defense

capabilities and decided the Coast Artillery was best suited for this mission. The Army's decision was eminently practical. The Army, as did most militaries of the time, realized the difference in approaches necessary to destroy a moving target vice a fixed target with indirect fire and had consequently separated the Field Artillery from the Coast Artillery. The Coast Artillery's primary mission being to defend our ports from enemy naval bombardment. As part of this mission they were required to destroy ships that were moving, perhaps at 10-15 knots. This required the development of weapons systems whose azimuth and elevation could be changed rapidly and whose range was equal or greater than that of naval guns. It was only practical that since the airplane was a moving target the Coast Artillery was the best choice to develop systems to defeat this new threat.[5] As the threat of naval bombardment became less likely, the Coastal Artillery gradually migrated more and more to an anti-aircraft artillery role. Again this occurred more by necessity and practicality than by design. The Coast Artillery fought bitterly to keep its traditional mission despite the realities of the evolving world.[6] This historical footnote is very relevant to today's discussions concerning AMD transformation. The capability presented by today's threats must be looked at against this historical backdrop and there must be a realization that the time has come to evolve once again in light of the emerging missile threats. Just as naval bombardment no threatens our ports the military jet no longer poses the most significant threat to our military.

During World War II anti-aircraft artillery played an essential role in protecting our tactical forces. Tactics, techniques, and procedures were developed to improve and enhance the effectiveness of weapons. Early warning systems were developed, first acoustic, and then radar (radio detecting and ranging). It was during WW II that the devastating effects attained from the synergistic use of early warning, ground-based anti-aircraft artillery, and fighter aircraft in a coordinated way was discovered. It is interesting to note that 50 years later the Army has the same organizational framework that it developed in WW II. Two prime examples of effective and integrated air defense systems are the German's defense against the Allied strategic bombing efforts and British defenses during the Battle of Britain. The large losses of aircraft in both of these operations drove the air forces of both sides to try night bombing. However, the technology of the times did not support the accuracy required and consequently had only marginal success. Toward the end of WW II we saw the emergence of several technological innovations that would arguably dominate the rest of the 20th century: nuclear fission, jet engines, and rocket technology. Both the Germans and Japanese developed military aircraft with jet engines. The German's produced militarily significant numbers of jet aircraft during WW II. The Japanese developed a suicide jet propelled bomb but it did not see wide spread

operational use. The Germans were the first to employ the cruise missile (V-1) and ballistic missile (V-2) in large scale military operations. It is estimated that the Germans fired over 20,000 V-1s during WW II.[7] Much has been written on the impact of nuclear weapons and the jet engine on military affairs. However, there is far less written about the introduction of the ballistic and cruise missile into modern warfare, that is until Operation DESERT SHIELD/STORM in 1990-1991. Most think of the V-1 and V-2 missiles in terms of the attacks on London, but in fact a much larger application of this new form of warfare occurred between October 1944 and April 1945 at the port of Antwerp. The Allies had captured the strategically important port of Antwerp and had plans to use it as a central means of bringing in the supplies necessary to support the final push into Germany and consequently end the war. The Germans, with a very limited offensive capability for removing the Allies from Antwerp, decided to use the V-1 and V-2 missiles to destroy the port facilities. In today's military jargon this would be called "anti-access efforts."[8] By current technological standards the V-1 and V-2 were crude and inaccurate weapons, but it must be remembered that the Allies air defense capability was equally crude and inaccurate. The Germans attacked Antwerp with over 5,000 V-1 "Flying bombs" during the 154 day period between October and April.[9] At times the Germans fired over 160 V-1s a day into Antwerp. The V-1 was very small in comparison to the aircraft that were used during WW II. It had a wing span of only 17 ft, normally flew at an altitude of 1,000 to 3,000 feet at approximately 450 miles per hour.[10] The combination of speed, small size, and low altitude made them a very difficult target for the weapons of that time. In order to protect the Antwerp port facilities the Allies were forced to deploy essentially a division-sized element with over 22,000 men, 336 heavy guns (90mm), and 188 light guns (40mm).[11] This was unprecedented then and is unimaginable by most experts today. Due to the pressing need for Allied aircraft in support of ground operations (Battle of the Bulge) there were no aircraft allocated to the air defense of Antwerp. There were an undetermined number of V-2 rockets fired as well, but the commander of the air defenses around Antwerp, BG Armstrong, stated that the Allies could offer no defense for that weapon.[12] The German V-2 was a very large weapon even by today's standards. It was 46 feet long, and weighed 28,380 pounds fully fueled. The V-2 had a range of 200 miles and had an incredible velocity of 5,600 feet per second which was twice the speed of a .30 caliber rifle bullet.[13] It carried a 2,200 pound warhead. It took 28 men approximately 90 minutes to move the V-2 into position and fire it. Had the Germans produced the V-2 in larger quantities earlier in the war it may have had a much more significant military impact. The point that is most relevant here is that the first large-scale production and use of cruise and ballistic missiles appeared in 1943 and 1945 respectively, yet we did not develop

effective counter-measures against these threats until almost 50 years later. It is interesting that the Army, Air Force, and Navy all aggressively adopted the technology that was used in these weapons to develop an offensive capability with jet aircraft, rockets, and space vehicles. As was true prior to WW I with the airplane, very little energy was devoted to developing a counter to these weapons despite the fact that the Soviet Union was developing enormous quantities of ballistic missiles and short range rockets. Mr. Peters' statement about preparing for the war we want comes to mind again. In fact, it could be argued that the Army still applies very little of its resources to develop capabilities to defeat cruise and ballistic missile threats. This observation is made based on a close examination of the types of air defense systems that have been fielded since 1945. Another important point that can be taken away from Germany's introduction of cruise and ballistic missiles is that they were not used as tactical weapons. Meaning specifically, that their use was not designed to defeat tactical forces. The Germans instead chose to employ them against what they saw as operational and strategic level targets (i.e., Antwerp, and London). One can only imagine what the impact of having to move 22,000 air defense soldiers to a single city would have had on the force protection of the tactical formations had the Allies not essentially defeated the Luftwaffe by 1944.

During the Cold War period, the Army went to great lengths to build a very robust air defense network for the continental United States for what is now called homeland defense. Every major city had permanently stationed long range air defense systems (i.e., Nike Hercules) in their suburbs all centrally controlled by North American Air Defense Command. There were fighter squadrons on alert also controlled by North American Defense Command. In Europe, NATO built an enormous integrated air defense system to defend Western Europe based on a series of belts that provided layered defense in depth. Both of these defenses were designed, at least initially, to defeat the larger scale, WW II style, bomber attacks. These attacks of course were expected to be nuclear instead of the high explosive variety of WW II. As the missile technology improved and aircraft became more sophisticated and expensive both the U.S. and Soviet Union realized that large scale bomber attacks were not feasible nor necessary. This occurred in the early to mid 1960's and is evidenced by the gradual inactivation of the air defenses around the major US cities. The exception being the southern tip of Florida where the Army kept air defense forces until the late 1970s because of the threat posed by Cuba. It is important to note that during the Cold War years the ground based air defense systems shifted from projectile-based weapon systems to missile-based systems. This was done out of necessity because the speed, range, and accuracy offered by missiles was far greater than anything that the physics of a gun would allow. However, the Army and Air Force became

fixated on defeating high performance fixed wing aircraft and helicopters. The cruise and ballistic missile defense lessons learned from the end of WW II were forgotten. As the Army moved away from the massive curtains of gun fire that it used to destroy V-1s and moved towards the precision offered by missile technology little concern was given to cruise missiles as a threat. Tactical high performance aircraft were seen as the only aerial threat to ground forces. This was not true then and is not true now. Ballistic and cruise missiles were increasingly viewed as only a threat to the rear areas and hence the Army did not and to some extent still does not consider that a high priority. Little thought was given to operating in an asymmetrical environment where the lines between tactical, operational, and strategic become blurred.

With the collapse of the Soviet Union came a corresponding draw down of the U.S. military. The draw down was temporarily delayed by Operation DESERT STORM in 1991. The U.S. was enormously successful in DESERT STORM and it was clearly evident that on the tactical level the Army was unmatched in the world. However, we also saw that there were major shortcomings in our military capabilities. The major one of note was defending against ballistic missiles that may carry weapons of mass destruction (WMD). Specifically, the Army's highly publicized ability to engage ballistic missiles was more fortuitous than planned. The Army had been exploring with the Patriot weapon system's prime contractor on modifications that would allow it to shoot down ballistic missiles prior to Iraq's invasion of Kuwait. As it was, the software modifications had never been tested prior to its operational use during Operation DESERT STORM. The strategic surprised of the Iraqi invasion of Kuwait and the Army's serious need to defend its forces and its allies from ballistic missile attack and possible WMD effects forced the software's early use. The Patriot did not destroy the actual warheads but did defeat a portion of the Iraqi missiles from striking their intended targets. It is interesting that the Army did not completely embrace the Patriot's ability to defeat ballistic missile threats and chose not to purchase additional systems or convert its Cold War era "aircraft centric" capability to a "missile centric" capability. The Army's approach to developing this capability has been plagued with uncertainty and an unwillingness to embrace the mission which is reminiscent of the military's approach to the airplane during the years between WW I and WW II.

CURRENT AND FUTURE AIR AND MISSILE THREATS

> You will usually find that the enemy has three courses of action open to him, and of these he will adopt the fourth.
>
> —Field Marshal von Moltke[14]

Since Operation DESERT STORM and Iraq's use of ballistic missiles against Saudi Arabia, Israel, and US forces there has been much discussion on how serious this kind of threat is to the U.S. As the above historical background has shown there has been a legitimate military threat from cruise and ballistic missiles for over a half a century. The Army, because its focus is primarily on tactical weapons and formations, and also because it has been technology-limited has not considered these threat sets a priority. Ironically, the Army has found itself with the Nation's only ballistic missile capability and has done very little to field additional capability. The lack of attention that AMD has gotten in the Army is most clearly highlighted by the fact that 12 years after Operation DESERT STORM and 4 years into transformation 26 of the Army's 36 AMD battalions have no capability to defeat UAVs, cruise or ballistic missiles. They remain organized and equipped to defeat Cold War-era fixed and rotary-wing threats.

It is important to understand the emerging threats and their definitions. While this may seem unnecessary, it has proven quite difficult for missile experts to agree on clear definitions. In fact, there is no universally accepted definition of what constitutes a cruise missile. While what is generally accepted is that a cruise missile is an unmanned, self-propelled vehicle that sustains flight through the use of aerodynamic lift over most of its flight path.[15] The more sophisticated cruise missiles will fly along a predetermined course and altitude to a predetermined target. Less sophisticated missiles may not have a precise course or altitude but the target location is usually predetermined. Cruise missiles are generally one-time use weapons, meaning that they are destroyed in the process of attacking a target. This is an important distinction since a system like the USAF's Predator when armed with Hellfire missiles could be defined as a cruise missile, except that it is not a one time use weapon. Ballistic missiles are defined as any missile which does not rely on aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated.[16] In addition, there are further subcategories of ballistic missiles based primarily on their range. These include, Long Range Ballistic Missiles (LRBM) also referred to as Intercontinental Ballistic Missiles (ICBM), Medium range Ballistic Missiles (MRBM), and Short Range Ballistic Missiles (SRBM).

An aerial threat that is of more recent origination is the Unmanned Aerial Vehicle (UAV). These are defined as powered aerial vehicles that do not carry human operators, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload.[17] UAVs are currently used for reconnaissance, intelligence, communications, and direct attack. UAVs were first used by the US in China during the 1960s. In fact, one of the first Chinese UAVs was partially developed by reverse engineering one of our Firebee unmanned aerial vehicles that was lost

over China.[18] UAVs have several advantages and disadvantages that have made their use challenging to date. Advances in technology over the last 10 years have enabled UAVs to dramatically increase their value to military operations. The disadvantages to employing UAVs are that they normally require communication with a ground station and while they are generally smaller than manned aircraft they are still quite large and require flat surfaces to take off and land. This normally results in a large footprint and provides a radio frequency (RF) signal that can be jammed. As more effort and energy in terms of research and development has been expended, the size of UAVs are being reduced with stealth technology now being applied. This is driven by the desire, particularly by foreign militaries to employ UAVs undetected by an enemy. From an AMD perspective this is very much a two-edged sword. The same technology that allows the US to produce a capability will inevitably become available to other countries. The only question is how long will it take. This is a central point to understanding the seriousness of the threat posed by both cruise missiles and UAVs. Mr. Christopher Bolkom, an analyst in the National Congressional Research Service, during testimony before the Senate subcommittee on International Security, Proliferation, and Federal Service in June 2002, made three observations concerning cruise missiles: 1) almost all cruise missile technologies have legitimate commercial and civil applications; 2) because cruise missile technologies are widely found in the civil aviation industrial base, their proliferation is difficult to monitor; and 3) due to the previous two points, cruise missiles offer great potential for technological surprise. They can emerge quickly and without warning.[19] All three of these points also apply to UAVs. The constraints placed on the proliferation of cruise and ballistic missiles by the Missile Technology Control Regime (MCTR) and the Wassenaar Arrangements are very hard to monitor and control when there is dual use technology involved. Ballistic missile technology tends to be easier to control because much of it is currently single use.

Cruise missiles and UAVs have enormous appeal to countries that cannot match the US in traditional military terms. The success that the US itself has had in the use of these weapons creates considerable desire for imitation. The relative low cost of cruise missiles and UAVs compared to that of manned aircraft is very attractive. Current cruise missiles cost anywhere from $1 million per copy for the most capable (i.e., Tomahawk) to $250,000 for a Russian AS-11.[20] UAVs are generally much cheaper. For nations that cannot afford to maintain the enormous overhead of operating an air force this is very compelling. If you consider that even one of these weapons accurately placed could achieve strategic results it is a bargain. The U.S. is currently demonstrating how strategically important AMD is by deploying Patriot missile batteries to Turkey, Israel, Jordan, Saudi Arabia, and Kuwait as part of current military

operations being conducted against Iraq. The Iraqi ballistic missiles are inaccurate and will most likely be tactically insignificant. Since the Army's focus is very much at the tactical level, this is perhaps explains why the Army has had a difficult time developing a capability to meet these operational and strategic threats. From a strategic point of view they are very significant as a means of striking population centers, delivering WMD, or as a means of influencing other countries foreign policy. An excellent example of the use of this type of technology to "level the playing field" is the Argentine use of a few French Exocet missiles in the Falklands war. They came very close to defeating the British.[21] Mr. Dennis M. Gormley, a prominent cruise missile expert, in a statement to a Senate subcommittee on cruise missile proliferation, brings this issue into sharp focus as it could apply to the US military. He testified that:

> Regional states facing any U.S. led coalition cannot expect to see their aircraft survive much beyond the first blow of any campaign. Yet cruise missiles (and UAVs) launched from a variety of survivable platforms would enable a state to mount a strategic air campaign….all without achieving air superiority. In this connection military effectiveness interacts closely with the growing vulnerability of American-style force projection, especially it dependence on short-legged aircraft, ground forces, and related logistical support operating out of a few forward bases.[22]

Several factors make cruise missiles and UAVs very difficult to defend against. They both have relatively small radar cross-sections which make them very difficult to acquire at distances. As stealth technology is applied to these weapons this problem will grow dramatically. The infrared heat signature of these weapons is significantly less than traditional military aircraft that our current arsenal of heat seeking missiles was designed to defeat. The very low flight profile of cruise missiles also complicates long range detection. In particular, the low flight profile significantly impacts airborne surveillance because of radar "clutter" from the ground which serves to conceal the cruise missile. While it may seem counter-intuitive, the relatively slow speed of UAVs (less than100mph) presents a serious challenge for airborne radars that were designed for fast moving military aircraft. Sophisticated airborne radars filter out slow moving targets on or near the ground in order to prevent their data processing or displays from being overwhelmed. Again, it would seem that we have prepared for the war we want to fight not the one we will be faced with.

It should now be evident that cruise missiles and UAVs have many features that would make them attractive to non-state actors as well as the traditional states of concern. Their relative simplicity, low cost, long range, and potential strategic impact has powerful appeal, particularly for well-financed transnational terrorist organizations. The lack of control we have over dual use technology serves to work to the terrorist's advantage. Unless a launch was

observed it would be next to impossible to determine the launch point of a cruise missile for a reprisal. All of this fits neatly into the traditional tactics of terrorists. In fact, according to congressional testimony the latest National Intelligence Estimates have looked at the covert conversion of a commercial container ship as a launching platform for a cruise missile.[23]

The ballistic missile threat is well documented and will not be discussed in as much detail as was cruise missiles and UAVs. While the technology used in ballistic missiles lends itself to effective monitoring thorough non-proliferation agreements it must still be realized that China, India, Iran, Iraq, Israel, and North Korea have not signed either the MTCR or the Wassenaar Arrangement. In fact, half of the current manufacturers of cruise missiles and UAVs are not participants in these agreements. It should be further noted that Israel and China have signed informal agreements to abide by these guidelines. Ballistic missiles are large weapons that require considerable infrastructure to employ (vehicles, fuel, power, etc.) and still have a relatively high failure rate. As the name implies ballistic missiles fly a ballistic path that permits a defender to rapidly predict both the impact point and launch point assuming of course that the missile is detected early in flight. This can enable the defender to target the incoming missile, take protective measures at the predicted impact point, and potentially target the launch point for destruction. The three most significant advantages of ballistic missiles are their speed, range, and payload capacity. It is only with the advent of the PAC-2 Patriot air defense system in 1991 that a nation has had the capability to destroy a ballistic missile in flight. The closure rate between an Iraqi ballistic missile and a Patriot missile was approximately 3 kilometers/sec. It requires enormously high speed computers and communication between the Patriot radar and missile in order to provide course updates quick enough to enable the destruction of a missile closing at 3 km/sec. The technology that was demonstrated in Operation DESERT STORM with the Patriot missile system was historic and opened the door toward negating a threat that has not had a counter-measure for the last 50 years. This having been said, it is very expensive to produce systems that can engage high altitude and high speed targets like ballistic missiles. The cost effectiveness is questionable to many as is evidenced by the extensive and often heated arguments surrounding the National Missile Defense program. Fundamentally it is far cheaper to produce a ballistic missile than it is to build a system to defend against it. For example, the latest Patriot missile (PAC-3) costs approximately $3 million each, while the National congressional research service estimates that China has offered their M-11 and M-9 ballistic missiles for sale at $1-2 million.[24]

CURRENT CAPABILITIES

> The military mind always imagines that the next war will be on the same lines as the last. That has never been the case and never will be.
>
> —Marshal of France Ferdinand Foch[25]

The Secretary of Defense and the Chief of Staff of the Army have challenged the Army to change in order to meet future threats. Basically they are repeating the words of Marshal Foch. Under Gen Shinseki's leadership the Army has embarked on the uncertain journey of genuine change. The old axiom, "if it ain't broke, don't fix it" still haunts us, but momentum for change is building. The Army is taking a critical look at the constructs of its organizations, training, capabilities, and doctrine. It has already begun to field the Stryker brigades as medium weight force to fill the gap between current heavy and light brigades. Many inside and outside the Army have questioned the effectiveness of the changes and this will probably continue as long as the rapid pace of change continues. An excellent description that is particularly reflective of the Army's current transformation status was made by Field Marshal Wavell in his book The Army and the Prophets in 1930. He wrote, "the problem which faces the reformer of armies in peace might be likened to that of an architect called on to alter and modernize an old-fashioned house without increasing its size, with the whole family still living in it (often grumbling at the architect's improvements, since an extra bathroom can only be added at the expense of someone's dressing room) and under the strictest financial limitations."[26] It is appropriate to examine if the Army has given adequate thought to transformation in terms of AMD. In order to accomplish this, a review of current and projected capabilities is needed along with a review of the organizational framework of the Army's AMD force

It is assumed that any use of AMD will be in a joint environment with all services most likely participating and with the USAF having ultimate command and control. However, one must recognize that the Army has by far the preponderance of ground-based air defense capability and determines to a large degree what air defense capabilities the nation will or will not have. In the last 10 years the Army and USMC eliminated the last of their air defense gun systems. This has left both services totally reliant on missiles for aerial protection. The decision to move away from guns was based primarily on their lack of range and accuracy. As the stand-off range of traditional fixed and rotary wing aircraft grew the gun became obsolete. Little thought was given to evolution of future threats or use of unconventional threats (i.e., small airplanes). A couple of factors that are not regularly considered is the cost of missiles (both

procurement and life cycle) versus conventional ammunition, and the singleness of purpose that missiles have. For example a Stinger missile at that time cost approximately $80,000 dollars while the cost of a 20 mm round was less than $5 dollars a round. A gun also had the advantage of being used against both ground and air targets. Air defense missiles are only effective against air targets because of the type of warhead used. Considerable flexibility was lost both in terms of spending and tactical employment to gain accuracy. It has also been pointed out in congressional testimony the seriousness of the flaw in our current missile approach to AMD. It was pointed out to Congress that the cost of the new Patriot PAC-3 missile is between $3-5,000,000 per round (not including the one-time cost of upgrading the Patriot system) and this compares very unfavorably with $200,000 cruise missiles or simple $50,000 airplanes. Because our ballistic/cruise missile, and UAV defenses depend largely on the same high-cost air defense interceptors (Patriot is the only system capable of engaging all three target sets) both the cost and ability to engage both target sets simultaneously would be very difficult.[27] The purpose of highlighting these points is not to make an argument for returning to gun-based AMD, but to show how these decisions are affecting our AMD capability today. The conventional Cold War mentality that drove decisions affecting AMD capability in the past are still driving decisions concerning our future AMD capability. The failure to develop a relatively low-cost robust capability to defeat cruise missiles and UAVs will eventually be exploited. Just as the increased stand-off range of aircraft drove the decision to eliminate the air defense gun, the demonstrated effectiveness of the USAF in achieving air superiority is potentially driving the elimination of AMD assets. In previous paragraphs it has been shown that an integrated, synchronized, redundant, and layered air defense network utilizing air and ground systems has proven to be the most effective way to ensure the defeat of stressing air threats. However the risks involved in the 21st century are much greater. The Army has eliminated almost all redundancy in its AMD force and arguably has failed to meet the requirements of combatant commanders in terms of missile defense.

Specifically the Army has only two means of destroying high performance aircraft (Patriot and Stinger) and one means of destroying ballistic missiles (Patriot). The Army does not have a cost effective capability to defeat a cruise missile or UAV threat. Numerous Army leaders have asked the question of when was the last time ground-based air defense assets shot down an airplane as a precursor to reducing or eliminating AMD capability. Unfortunately the very nature of this question demonstrates clearly how conventional thinking still permeates the Army and how unprepared we are to make changes. The answer to the question is found in DESERT STORM and again in IRAQI FREEDOM. It is missiles, not fixed-wing or rotary wing aircraft, that

will threaten our nation and maneuver forces in the future. The framing of the question in terms of history (aircraft) instead of the future (missiles) has resulted in the severe curtailment of AMD modernization outside of Patriot in order to fund the Stryker brigades and Future Combat System (FCS) development.[28] The cumulative affect of these actions has left the Army without an effective capability to protect the nation or its maneuver forces from cruise missiles or UAVs. Even worse it has left the Army without a resourced plan to provide this capability in the future.

As stated earlier, the Army currently has two air defense weapons. These are the Stinger missile system and the Patriot missile system. Both are unique in several ways. The Stinger is a shoulder-fired, man-portable, heat seeking missile that has a range of approximately 5 kilometers. It is a certified round that can be fired right out of the storage container. The missile has great flexibility in that it can be fired from multiple platforms (i.e., wheeled, tracked, etc.). The platforms add increased C2 and optics but do not improve the performance of the missile in terms of range, sensitivity, etc. The Stinger was specifically designed to defend against high performance military fixed and rotary wing aircraft operating at altitudes below 10,000 feet. It was not designed to defend against cruise missiles and UAVs. The infra-red (IR) signature of most UAVs combined with their operating altitude of 12-15,000 ft makes the Stinger ineffective against those threats. From head-on aspect angles cruise missiles have a very small IR signature. This makes proactive engagements unlikely. Reactive engagements (after a cruise missile has flown by) may be possible but this does protect the force from the effects of the missile. In order to fund FCS the Army terminated the Stinger program in 2002 and will no longer procure new Stinger missiles. The Stinger remains the nation's only man-portable air defense system and is currently used by all services.

From an organizational perspective, the Army has 10 active component divisional air defense battalions that are equipped with Stinger missiles. None of these battalions have a true capability to protect their maneuver units effectively from cruise missiles or UAVs. The question that must be asked is why have we not transitioned these units to give them a cruise missile/UAV capability. Why would the Army maintain these units with a capability that we do not need. The answer to this seemingly simple question lies in the disjointed approach that the military is taking to missile defense as a whole.

The Office of the Secretary of Defense (OSD) has given the mission for developing missile defense systems and architecture to the Missile Defense Agency (MDA). MDA is responsible for developing capabilities in coordination with the services. However, MDA 's mission only applies to ballistic missiles and not to cruise missiles or UAVs.[29] The development of capabilities against these threats remains a service responsibility. Mr. Gormley in his

statement to Congress concerning the preparedness of the military services to defeat cruise missile threats stated:

> The Pentagon seems to recognize that the cruise missile threat could emerge suddenly, as it own planning guidance specified that capabilities are needed to defend against cruise missiles by 2010. Moreover, that guidance also directed the services to be positioned to respond to an even earlier emergence of the threat. However, not enough progress has occurred in either theater cruise missile defense or national cruise missile defense. Piecemeal efforts will not add up to an effective wide-area defense against the threat.[30]

Each of the services has different approaches and in fact slightly different requirements based on their operating environments. The concern that this paper attempts to bring to light is that the Army has not developed and approved a plan nor identified and allocated resources to provide the service and joint force commander with a cruise missile or UAV capability in the near future. The Army and USMC are pursuing the possibility of developing a ground launched AIM-120 (Advanced Medium Range Air-to-Air Missile) using a common missile already employed by fighter aircraft. The development of this system is in specific response to the acknowledged gap in protection against cruise missiles. In the Army's case, however, there are currently only plans to buy one battalion. This does not constitute a tactically significant capability.

CONCLUSION

Field Marshal Moltke's observation concerning enemy courses of action is timeless and well understood by any military leader, but ironically it seems his caution is being ignored by the Army in its approach to developing defenses against the aerial threats emerging in the 21st century. Serious questions by many leaders in the U.S. military are being asked about the relevance of maintaining a ground–based air defense capability. The logic supporting their arguments is limited to the context of the Cold War model of expensive high performance aircraft that defeat enemy defenses with speed, maneuverability, and a pilot. Close examination of current technology and its inevitable dissemination shows us a future where it will not be in an enemy's best interest to maintain a traditional air force because of its expense and vulnerability (airfields). Missiles and UAVs offer a deployable, hard to find, relatively inexpensive means to exploit the advantages of air power. Despite having complete overmatch against any foreseeable enemy ground force the Army continues to invest heavily in new direct fire weapon systems designed to kill enemy soldiers and their armored vehicles without comparable investment in a capability to defend the force or our nation from cruise missiles or UAVs for which we have almost no defense. As Mr. Peters correctly observed and we have done many

times throughout our history the Army (in terms of AMD) is preparing to fight the war we want to fight and not the one that will find us. While it is essential that the Army maintain its tactical focus it cannot lose sight of its role at the operational and strategic levels of war. While currently and in the near term enemy ballistic/cruise missiles and UAVs will not likely pose a significant tactical challenge to our ground forces, they have already shown that they can have a tremendous operational and strategic impact. For example, if we cannot defend our allies (or help them defend themselves) or defend major population centers it will directly impact our nation's ability to build coalitions and negotiate basing rights for our forces. Today with only 10 Patriot battalions the Army is very limited in what it can protect from incoming missiles and UAVs. In the future, our own offensive success with cruise missiles and UAVs, and their relative "bang for the buck" will certainly encourage more nations to develop these capabilities. All the while the Army is on a glide path that may see our ability to defend against them overwhelmed. The Army nor OSD has yet produced a resourced plan to mitigate this eventuality. When transforming an organization as large as the Army not everything can be made a priority. However, where there is no pre-existing existing capability or the capability that does exist has no redundancy or depth, as is the case with AMD, extreme care must be taken to ensure that we develop the capabilities we need and not the ones we want.

WORD COUNT = 7,008

ENDNOTES

[1] Ralph Peters, Fighting for the Future; Will America Triumph? (Mechanicsburg, PA: Stackpole books, 1999), 35.

[2] Ibid., 22.

[3] Charles J. Dunlap, Jr., "Preliminary Observations: Asymmetrical Warfare and the Western Mindset," in Challenging the United States Symmetrically and Asymmetrically: Can America be Defeated?, ed. Colonel (R)Lloyd J. Mathews (U.S. Army War College Strategic Studies Institute, Carlisle Barracks, PA).

[4] Peter G. Tsouras, The Greenhill Dictionary of Military Quotations (Mechanicsburg, PA, Stackpole Books, 2000), 231.

[5] Anti-Aircraft Journal, The ROTC manual: Coast Artillery History (Washington, D.C.: Coast Artillery Journal, 1931), 28.

[6] Ibid., 32.

[7] BG Claire Armstrong, The Story of Antwerp X, Artillery School (U.S.), Anti-Aircraft and Guided Missiles Branch, Department of Guided Missiles, 1949, p 3.

[8] COL Dan Kirby, "Air and Missile Defense Operational Concept Modernization," briefing slides with commentary, Fort Bliss, U.S. Army Air Defense Artillery School, 6 December 2002.

[9] Armstrong, p 6.

[10] BG George M. Badger, "Some Sidelights on Antwerp X," Coast Artillery Journal, (October 1945): 44.

[11] Armstrong, p11.

[12] Ibid.

[13] MAJ Hal D. Steward, "V-2 The "Atomic Age" Weapon," Coast Artillery Journal, (June 1946): 44.

[14] Tsouras, 495.

[15] Congress, Senate, Governmental Affairs Committee, Sub-committee on International Security, Proliferation, and Federal Services, Statement of Christopher Bolkcom, Analyst in National Defense Congressional Research Service, Hearing on Cruise Missile Proliferation, 107th Cong., 2nd sess., 11 June 2002; http://www.senate.gov/~gov_affairs/061102bolkcom.pdf; Internet: accessed 9 March 2003.

[16] Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, Joint Publication 1-02 (Washington, D.C.: JCS, 12 April 2001), 46.

[17] Ibid., 450.

[18] Hugh McDaid and David Oliver, Smart Weapons: The Top Secret History of Remote Controlled Weapons, (1997), available from http://www.epinions.com/content_55297543812; Internet: accessed 25 March 2003.

[19] Bolkom.

[20] Ibid., 2.

[21] Congressional Research Service, Report for Congress; Cruise Missile Proliferation, 3 July 2002, available from http://www.fpc.state.gov/documents/organization/13382.pdf; Internet; accessed 9 March 2003.

[22] Congress, Senate, Governmental Affairs Committee, Sub-committee on International Security, Proliferation, and Federal Services, Statement of Dennis M. Gormley, Hearing on Cruise Missile Proliferation, 107th Cong., 2nd sess., 11 June 2002, 1, available from http://www.senate.gov/~gov_affairs/061102gormley.pdf; Internet: accessed 9 March 2003.

[23] Ibid.

[24] Bolkom.

[25] Tsouras, 32.

[26] Ibid., 416.

[27] Gormley.

[28] Based on authors personal experience while serving on the Army Staff in DAPR-FDE during the FY 04 POM process.

[29] Missile Defense Agency Mission Statement, available from <http://www.acq.osd.mil/bmdo/bmdolink/html/mission.html>; Internet; accessed 9 March 2003.

[30] Gormley.

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